New methods for treatment of hospital waters with drug residues and bacteria hospital resistance

A.Keniche[(1),(2)], M.Z.Slimani[(3)], and A.Khelasi[(1)]

[(1)] *Maghnia Center University, Tlemcen, Algeria.*
[(2)] *Laboratory of Organic Chemistry Natural Products and Analysis University of Tlemcen, Algeria.*
[(3)] *University of Chlef, Algeria.*
E-Mails: keniche_assia@yahoo.fr

***Abstract*—** Where do the wastewater from Algerian hospitals go? How to have a system of treatment of hospital wastewater at the hospital level before joining the treatment plants? In our work, it is to this problematic that our researches are directed, by developing a hydraulic system of adequate treatment of the hospital wastewater targeted at the level of each service, by two methods, photochemical and phytopurification, because the drug rejections (Antibiotic, psychotropic, chemotherapy, Bacteria resistance ...) are different from one service to another: Note that in Algeria and most Maghreb countries, there is no measurement system that can assess the importance the risk of hospital wastewater;

Key-Words— hospital; wastewater; Drugs; Cyclodextrin, inclusion complex.

I. INTRODUCTION

Hospital wastewater (WWs) represents a particular type of effluent, in compared with the urban wastewater. Hospitals generate on average 750 L of wastewater by bed and by day so they are 2-5 times higher than urban flow rates, which refer to one inhabitant equivalent (typically included in the interval 120-250 L) [1]. This significant quantity of water per day for the different purposes and services depending on the activities which take place within the structure.

The quantity of WWs produced in a hospital depends on different factors: bed numbers, hospital age, accessibility to water, general services present inside the structure (kitchen, laundry and air conditioning), number and type of wards and units, institution management policies and awareness in managing the structure in safeguarding the environment, climate and cultural and geographical factors [2]. These effluents are loaded with pathogenic microorganisms, pharmaceutical partially metabolized, radioactive elements and other toxic chemical substances. The Pharmaceutical compounds (Figure 1) include a wide range of chemicals with different structures, functions, behaviors, and activities and are used to enhance human health in the medical field. These compounds in waterwaste can contaminate surface water, ground water, and drinking water [3].

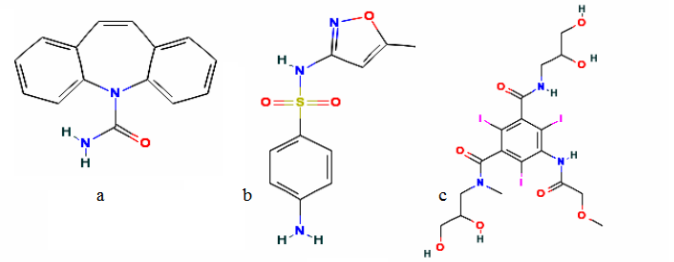

Figure (1) : a) Carbamazepin; b) Sulfamethoxazol; c) Iopromid.

Many other drugs can be found in (WWs), as antibiotics, wich are of concern due to potential genotoxic effects, disruption of aquatic ecology, promotion of antibiotic resistance, complications surrounding development of water reuse technologies, and possibly even increased human health risks[4].

The antibiotic-resistant bacteria might develop from long-term environmental exposure to low concentrations of antibiotics (ng/L–µg/ L), such as those present in wastewater and surface water. Although there is little data, one study has shown increased prevalence of antibiotic-resistant

Acinetobacter spp. in sewers receiving hospital and pharmaceutical plant wastewater effluent [5]. Although several studies have detected the occurrence of antibiotics in hospital effluent [6]. We found Very Few Algerian study on (WWs) from algerian hospital [7].

In addition the most Algerian hospitals do not have an effluent treatment strategy at the hospital level, before joining conventional treatment plants.

II. Result and Discussion

In this work we develop a model for the elimination of drugs from hospital effluents at the laboratory scale. We chose as a model a drug Liorésal® that carries an aromatic nucleus and acid and amine functions .

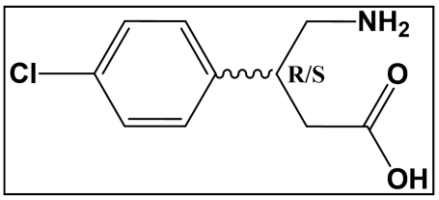

Figure (2) : Structure of Lioresal® .

The study of its complexation with (β-CD), can form a solid precipate and can be filtred from the (WWs). Much of the interest in cyclodextrins (CDs) research has been fuelled by commercial interests, and many of the published reports of complexation studies on small molecule-(CDs) interactions have a focus on pharmaceuticals [8].

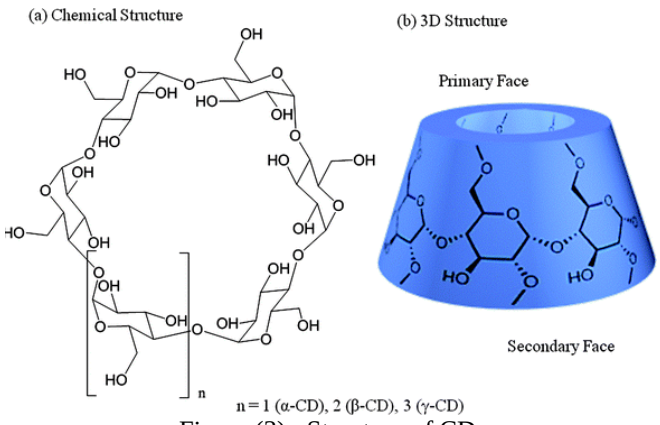

Figure (3) : Structure of CD.

Proposition of Solution

We propose below, a diagram for the treatment of hospital WWs, first the complexation of drugs with the CD will give solid complexes, which can be filtered later.

Figure (3) : Proposed scheme for the elimination of drugs from WWs.

Our small-scale method needs to be tested on a large scale. The advantages of our method are that using the environment-friendly CD, the CD will be recovered at the end for use again by dissociating the inclusion complex in solid form.

III. Conclusion

In conclusion, this work of eliminating the residues of hospital WWs medicines is an initiation that must be proven by applying it on a large scale. It should be noted, that the majority of our Algerian hospitals do not present a strategy of purifications of the hospital WWs. So, it is essential for us, as chemists and hydrolysis researchers to invest more in this field in order to establish this culture in ours Algerian hospitals.In the end , From this paper, I call for collaboration for the development of a model of hospital WWs treatment, at the level of clinics, hospitals, laboratories, dentists clinics . These effluents are still very little studied and which probably contributes to the various emerging diseases in our country and broad spectrum bacterial resistance.

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